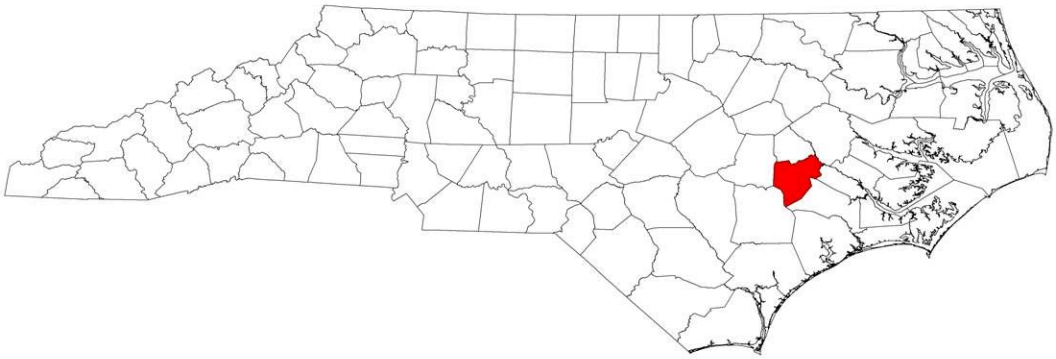
ANNUAL REPORT FOR 2005



Unnamed Tributary to Briery Run Mitigation Site
(Crescent Road Site)
Lenoir County
WBS Element 34501.4.1
TIP No. R-2719 WM

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SUMMARY

The following report summarizes the stream monitoring activities conducted during the Year 2005 along an unnamed tributary emptying into Briery Run, hereinafter referred to as the Crescent Road Site. The site, situated approximately two miles (3.2 kilometers) northeast of Kinston in Lenoir County, was designed and constructed during 2001 by the North Carolina Department of Transportation (NCDOT) in order to provide mitigation for stream impacts associated with the construction of Crescent Road. This report provides the monitoring results for the second formal year of monitoring (Year 2005); however, it is actually the fourth year since construction.

Based on the overall monitoring assessment, the Crescent Road Site has met the required monitoring protocols for the second formal year of monitoring. Both reaches of the unnamed tributary remain stable. There is extensive growth of vegetation throughout the stream corridor, both within and outside of the bankfull limits associated with the channel. One isolated area of erosion was observed along the second reach; however, this area is localized and does not appear to be compromising the project or reach in any adverse manner. All nine of the cross sections along the unnamed tributary remain stable. Based on information obtained from the US Geological Survey (USGS), the Crescent Road Site had met the required monitoring protocols for hydrology as it relates to bankfull events. No remedial work is proposed, or warranted, at the current time.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that were conducted during the summer of 2005 at the Crescent Road Site. The site is situated immediately south and adjacent to C.F. Harvey Road (Crescent Road) in the western portion of Lenoir County (Figure 1). It lies approximately 2 miles (3.2 kilometers) northeast of Kinston. The Crescent Road Site was constructed as an on-site stream mitigation project in order to provide mitigation for stream impacts associated with the construction of Crescent Road.

The US Army Corps of Engineers (USACE) permit for R-2719BA dated June 12, 2001 states that the Crescent Road onsite mitigation site is to provide a minimum of 0.58 acres of riverine wetland restoration and 1,706 linear feet of stream restoration to offset unavoidable impacts imposed by the adjacent roadway project. According to the as-built drawings of the site, the site actually restored 3.71 acres of riverine wetland restoration, 2,291 linear feet of stream restoration, and 7.6 acres of Neuse River buffer. The NC Department of Transportation (NCDOT) plans to use the additional available credits, above and beyond the credits required by the USACE permit, to offset future mitigation needs in the surrounding area.

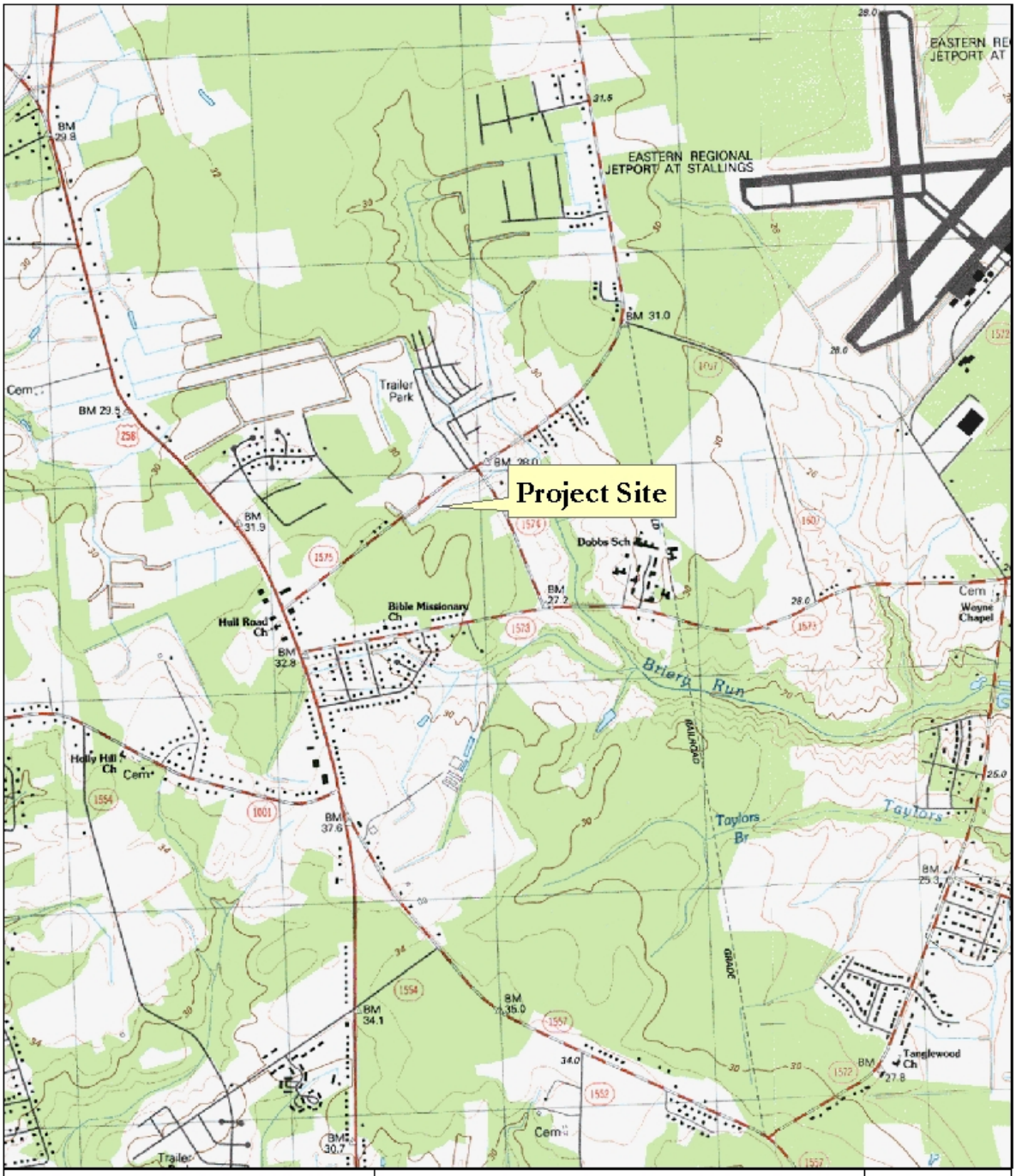
Design and implementation of the Crescent Road Site were implemented during 2001. The majority of the proposed stream restoration involved the construction of a new, stable channel exhibiting the characteristics (dimension, pattern and profile) consistent with data obtained from a nearby reference reach. One minor area of in-channel stabilization existed. Rootwads and rock vanes were installed to provide the required immediate stabilization to properly allow for the re-establishment of riparian vegetation. New floodplain areas were excavated and the adjacent streambanks were sloped to further to reduce overall erosion.

1.2 Purpose

The objectives for this mitigation site were to improve water quality, riparian quality and stability, and fisheries habitat associated with the unnamed tributary and its adjacent riparian areas.

Successful stream mitigation is demonstrated by a stable channel that does not aggrade or degrade over time. It is also demonstrated by reduced erosion rates, the permanent establishment of native vegetation, and bed features consistent with the design stream type. Results of the stream monitoring conducted during the 2005 growing season at the Crescent Road Site are included in this report.

Activities in 2005 reflect the second formal year of monitoring following the restoration efforts; however, it is the fourth year since construction. Included in this report are analyses on stability (primarily the longitudinal profile and cross sections) and site photographs.



North Carolina
Department of Transportation

PROJECT VICINITY
UT to Briery Run
Crescent Road Stream Mitigation Project
Lenoir County, North Carolina

Map Does Not Reflect Newly Constructed Road

1:24,000

0 750 1,500 3,000 4,500 6,000 Feet

USGS 7.5- Minute Topographic Quadrangles:Falling Creek, & Kinston
Contour Interval 2 Feet

Figure No.

1

1.3 Project History

Summer/Fall 2001	Construction Completed.
October 2004	Stream Channel Monitoring (Year 1)
July 2005	Stream Channel Monitoring (Year 2)

2.0 STREAM ASSESSMENT

2.1 Stream Monitoring Requirements

Based on the permit conditions associated with Action ID. 19991192, TIP R-2719BA, dated June 12, 2001, the following monitoring protocols were required for this project:

US Army Corps of Engineers (USACE):

1. The permittee shall contact the USACE, Washington Regulatory Field Office NCDOT Regulatory Project Manager and provide him with the opportunity to attend the annual mitigation monitoring efforts.
2. The permittee will submit the annual mitigation reports by December 31 of each monitoring year.

NC Division of Water Quality (NCDWQ):

1. Stream Restoration/Mitigation Success Criteria – NC Division of Water Quality
    a) Duration: 5 years from end of construction (channel modifications and vegetation planted) – based on the fact of 1.4-1.7 year bankfull return period.
    b) Reporting - Three (1st, 3rd, 5th years) Monitoring Reports sent at end of yearly monitoring period to the US Army Corp of Engineers (USACE) and the NC Division of Water Quality (NCDWQ) 401 – Wetlands group.
2. Streams – Geomorphology [*based on which parameters are restored (dimension, pattern, profile)*]
    a) Dimension
        1.) Permanent Cross-sections (surveyed or GPS) need to be established (1 per 20 bankfull – width) lengths
        2.) Based on reference streams and stream curves
        3.) Measurements: W/D Ratio, Entrenchment Ratio, Low Bank Height Ratio (low bank height/max bankfull depth)

b) Pattern
    1.) Plan View of project site
    2.) Based on valley type/stream type
    3.) Measurements: Sinuosity, Meander Width Ratio, and Radius of Curvature (on newly constructed meanders only 1st year monitoring)
c) Profile
    1.) Longitudinal profile
    Based on stream type
    2.) Measurements: Slope (average, pool, riffle), pool to pool spacing
    Materials
    3.) Pebble counts
    Based on reference stream and stream type
    4.) Established d50 and d85 should increase in coarseness in riffles, increase in fineness in pools
    5.) Measurement: Sampling based on % of Pools and Riffles
d) Photo Reference Points
    1.) One per Cross-section (show banks and channel)
    2.) Several structures

2.2 Stream Description

2.2.1 Post-Construction Conditions

The mitigation of the unnamed tributary to Briery Run involved new channel construction along two reaches, additional floodplain excavation and stream bank stabilization. A combination of rock vanes and rootwad revetments were used to provide immediate stabilization for the re-vegetation of the project site. Native trees and shrubs were planted to provide long-term bank stabilization. Three culverts were installed along the unnamed tributary. These culverts control channel gradient.

2.2.2 Monitoring Conditions

The unnamed tributary to Briery Run was designed to follow E5 stream type morphologies according to the Rosgen Classification of Natural Rivers. The project is separated into two reaches separated by the culvert situated under Crescent Road. A total of nine cross sections were surveyed (four on Reach #1 and five on Reach #2).

2.2.3 Site Photographs

Photo points were established during the 2004 monitoring year along the unnamed tributary in order to visually evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation and the effectiveness of erosion control measures. Photographs of the project only exist for the first (2004) and second formal monitoring years (2005). No photographs are available for the two years immediately after construction activities were completed. The photographs include six photo points along the unnamed tributary and

several additional overview pictures detailing the site. The photographs are presented in Appendix A.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the survey of nine cross sections along the two reaches, and the longitudinal profile of the unnamed tributary. The length of the profile was approximately 2,300 linear feet (1,118 linear feet of Reach #1 and 1,195 linear feet of Reach #2). No cross sections had been established prior to the 2004 monitoring year. Cross section locations are presented below. Benchmark stakes were installed on both the left and right stream banks for each cross section location. The layout comparisons of the cross sections and longitudinal profiles are shown in Appendix B.

- Cross Section #1. UT to Briery Run, Reach #1, Station 2+07, midpoint of riffle
- Cross Section #2. UT to Briery Run, Reach #1, Station 4+49, midpoint of glide
- Cross Section #3. UT to Briery Run, Reach #1, Station 6+22, midpoint of riffle
- Cross Section #4. UT to Briery Run, Reach #1, Station 8+60, midpoint of riffle
- Cross Section #5. UT to Briery Run, Reach #2, Station 2+11, midpoint of riffle
- Cross Section #6. UT to Briery Run, Reach #2, Station 4+63, midpoint of riffle
- Cross Section #7. UT to Briery Run, Reach #2, Station 6+09, midpoint of run
- Cross Section #8. UT to Briery Run, Reach #2, Station 8+06, midpoint of riffle
- Cross Section #9. UT to Briery Run, Reach #2, Station 10+66, midpoint of run

The nine cross sections were established during the 2004 monitoring survey are being monitored on a yearly basis to determine the actual extent of aggradation or degradation. All of the cross section locations appeared stable with little or no active bank erosion. Survey data collected during future monitoring periods may vary depending on actual location of rod placement and alignment; however, this information should remain similar in overall appearance. Morphological comparisons are presented in the charts depicted below. Appendix B depicts each cross section comparison as well as a summarized table of morphological variables.

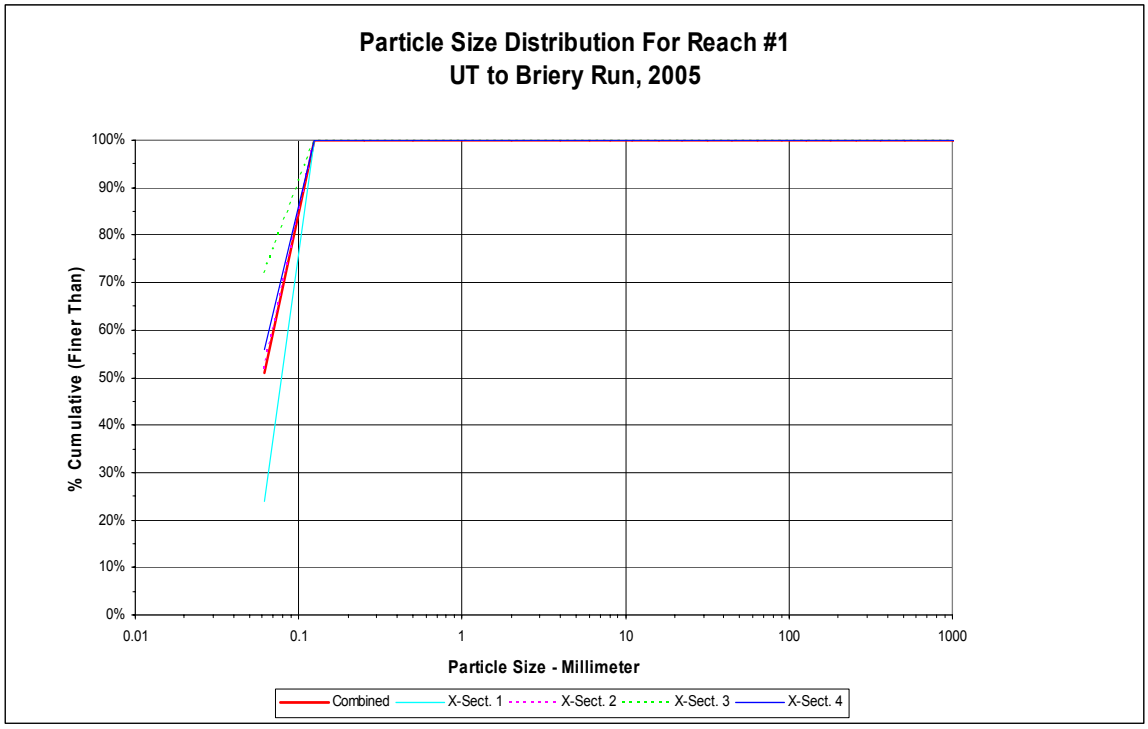
Table 1. Cross Section Comparisons - Reach #1							
Variable	**Proposed**	**Cross Section #1 (Riffle)**	**Cross Section #2 (Glide)**	**Cross Section #3 (Riffle)**	**Cross Section #4 (Riffle)**	**Min.-Max. (Riffle Sections Only)**	
		2005	**2005**	**2005**	**2005**	**2004**	**2005**
Drainage Area (sq. mi)	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Bankfull Width (ft)	8.9	5.7	7.9	7.6	7.0	5.7 - 8.4	5.7 - 7.6
Bankfull Mean Depth (ft)	1.0	1.0	1.0	0.9	0.9	0.8 - 0.9	0.9 - 1.0
Width/Depth Ratio	9.0	5.8	7.6	8.4	7.9	6.3 - 10.5	5.8 - 8.4
Bankfull Cross Sectional Area (sq. ft)	8.7	5.5	8.3	6.8	6.2	5.1 - 7.2	5.5 - 6.8
Maximum Bankfull Depth (ft)	1.5	1.7	2.1	1.6	1.7	1.5 - 2.0	1.6 - 1.7
Floodprone Area Width (ft)	28.9	>100.0	>100.0	>100.0	>100.0	100.0	>100.0
Entrenchment Ratio	3.3	>15.0	12.7	13.2	14.3	11.9 - >15.0	13.2 - >15.0
Average Slope	0.0081	0.007	0.007	0.007	0.007	0.007	0.007
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Particle Sizes							
D16 (mm)		<0.062	<0.062	<0.062	<0.062	0.069 - 0.071	<0.062
D35 (mm)		0.062	<0.062	<0.062	<0.062	0.07 - 0.08	<0.062 - 0.062
D50 (mm)	0.2	0.07	<0.062	<0.062	<0.062	0.1	<0.062 - 0.07
D84 (mm)		0.12	0.1	0.07	0.1	0.11 - 0.22	0.07 - 0.12
D95 (mm)		0.13	0.11	0.11	0.12	0.12 - 0.23	0.11 - 0.13
Stream Classification (Riffle Sections Only)	E5	E5	N/A	E6	E6	E5	E5

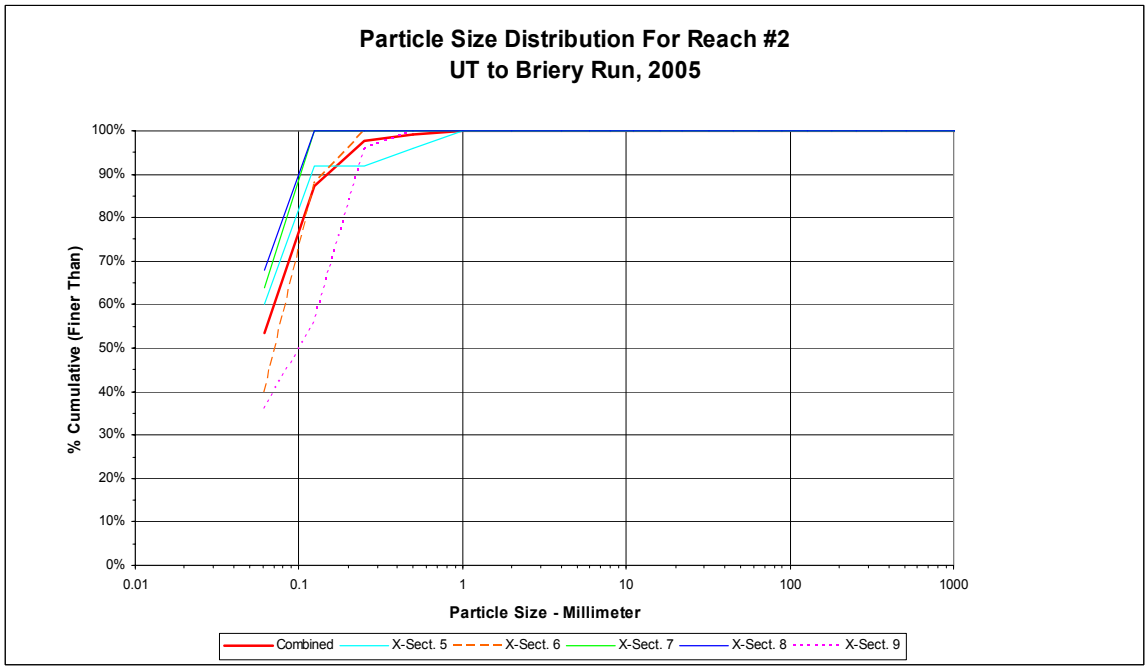
Table 2. Cross Section Comparisons - Reach #2								
Variable	**Proposed**	**Cross Section #5 (Riffle)**	**Cross Section #6 (Riffle)**	**Cross Section #7 (Run)**	**Cross Section #8 (Riffle)**	**Cross Section #9 (Run)**	**Min.-Max. (Riffle Sections Only)**	
		2005	**2005**	**2005**	**2005**	**2005**	**2004**	**2005**
Drainage Area (sq. mi)	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Bankfull Width (ft)	8.9	14.4	12.5	9.4	8.6	11.1	10.2 - 18.2	8.6 - 14.4
Bankfull Mean Depth (ft)	1.0	0.8	0.8	1.0	1.9	0.8	0.7 - 0.9	0.8 - 1.9
Width/Depth Ratio	9.0	19.1	15.1	9.8	9.0	14.0	11.3 - 23.1	9.0 - 19.1
Bankfull Cross Sectional Area (sq. ft)	8.7	10.8	10.4	9.1	8.2	8.8	9.2 - 16.4	8.2 - 10.8
Maximum Bankfull Depth (ft)	1.5	1.4	1.8	1.9	1.9	1.7	1.4 - 2.0	1.4 - 1.9
Floodprone Area Width (ft)	28.9	>100.0	>100.0	>100.0	>100.0	>100.0	100	>100.0
Entrenchment Ratio	3.3	7.0	8.0	10.6	11.6	9.0	5.5 - 9.8	7.0 - 11.6
Average Slope	0.0081	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Particle Sizes								
D16 (mm)		<0.062	<0.062	<0.062	<0.062	<0.062	<0.069 - 0.072	<0.062
D35 (mm)		0.062	<0.062	<0.062	<0.062	0.062	<0.07 - 0.09	<0.062 - 0.062
D50 (mm)	0.2	0.07	0.07	<0.062	<0.062	0.1	0.1	<0.062 - 0.1
D84 (mm)		0.12	0.11	0.07	0.1	0.21	0.13 - 0.15	0.07 - 0.21
D95 (mm)		0.13	0.18	0.11	0.12	0.24	0.18 - 0.19	0.11 - 0.24
Stream Classification (Riffle Sections Only)	E5	C5	N/A	E6	E6	N/A	C/E 5	C/E 5

According to the data collected during 2005, the average slope of the channel remained consistent with the data collected during 2004. Pool slopes, ranging between 0.0009 and 0.01, as well as riffle slopes, ranging between 0.0023 and 0.096, also remained consistent along both reaches. The average pool and riffle slopes were 0.004 and 0.018, respectively. The pool to pool spacing averages approximately 16 bankfull widths.

Pebble counts were taken at each cross section as a means to determine the extent of change in bed material during the monitoring period. Pebble counts taken at riffle sections were utilized to classify the stream. Existing data indicated the unnamed tributary was a sand-bed stream. The pebble counts taken during the Year 2005 monitoring period noted that the D_{50} (50 percent of the sampled population is equal to or finer than the representative particle diameter) for the riffle sections of the unnamed tributary was approximately 0.1 mm , which remains indicative of a sand-bed stream.

Charts depicting the particle size distributions for Reach #1 and Reach #2 of the unnamed tributary for 2005 are presented below.



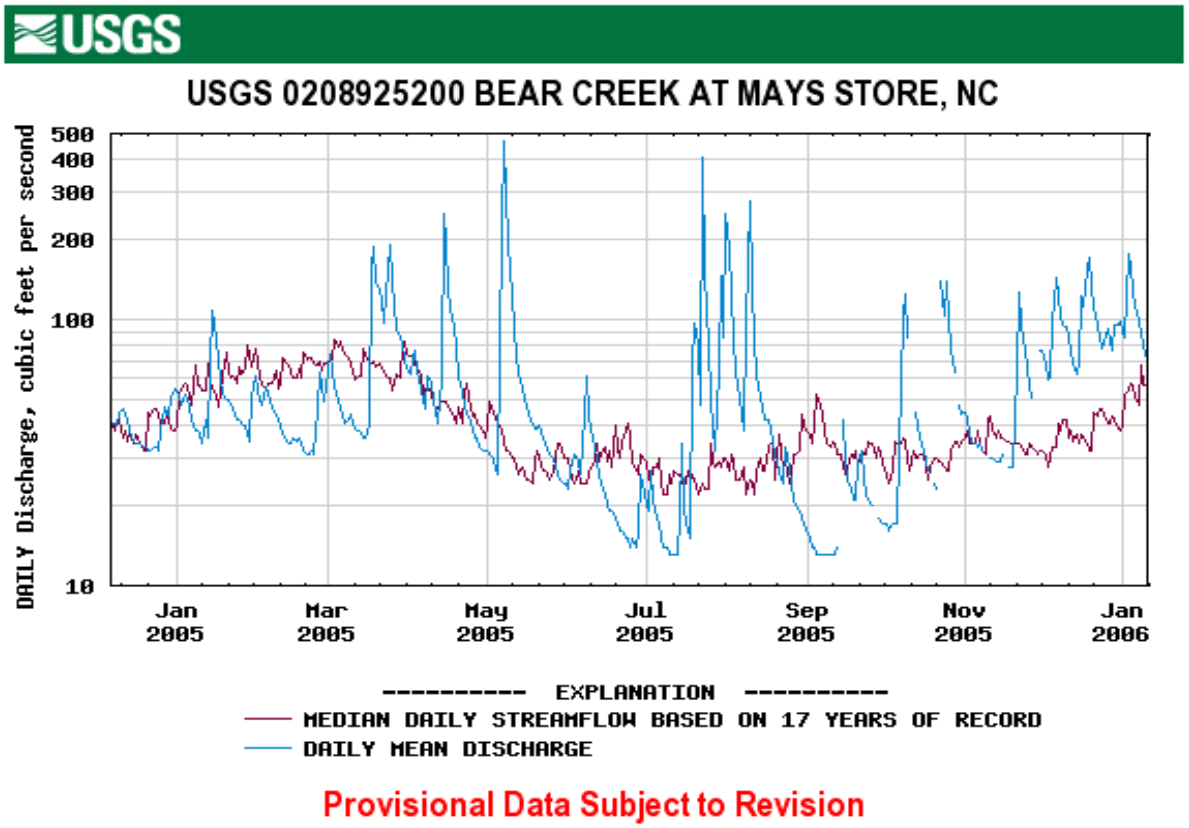


Longitudinal profile surveys were conducted along both restored segments of the unnamed tributary (Appendix B). Bank stability was assessed during the cross section and longitudinal profile surveys. One area of localized scouring was observed in both 2004 and 2005 along Reach #2 near Station 5+18. Although this scouring has undercut the stream bank along both sides of the channel, it does not appear to exhibit any detriment to the overall functions provided by the reach. Herbaceous vegetation continues to dominate the entire area associated with both reaches, both within and outside of the bankfull limits. The area of scouring and the herbaceous vegetation found in the stream will continue to be assessed during the next and future monitoring years, as applicable, to determine the overall success of the project.

2.3.2 Climatic Data

Monitoring requirements state that at least two bankfull events must be documented through the five-year monitoring period. No surface water gages exist on the unnamed tributary or its receiving water, Briery Run. A review of known USGS surface water gages identified two gages within 10 miles (16 kilometers) of the mitigation site: one along the Neuse River in Kinston and one along Bear Creek near Mays Store, approximately 2.5 miles east of the Wayne and Lenoir County boundary.

The Bear Creek gage was utilized for this report since it is the smaller of the two gages (57.7 square-mile drainage area as compared to the 2,692 square-mile drainage area associated with the Neuse River). The Bear Creek gage more accurately reflects hydrology and precipitation in the project area. It is situated in USGS Hydrologic Unit 03020202. Datum of the gage is 50 feet above sea level NGVD29. Based on the drainage area associated with the gage, the correlated bankfull discharge according to the NC Coastal Plain Regional Curves (USACE, 2003) is between 200 and 500 cubic feet per second (cfs). A review of peak flows was conducted for the period between October 2002 and October 2004, as well as January 2005 through January 2006. According to the graph, there were approximately eight bankfull events documented between 2002 and 2004 and two additional events during this monitoring period. This gage has met and exceeded the hydrological requirements in between 2001 and the current period. The USGS graphs depicting the peak flows occurring during 2005 is presented below.



2.4 Conclusions

Overall, both reaches of the unnamed tributary remain stable. There is extensive growth of vegetation throughout the stream corridor, both within and outside of the bankfull limits associated with the channel. One isolated area of erosion was observed along the second reach; however, this area is localized and does not appear to be compromising the project or reach in any adverse manner. All nine of the cross sections along the unnamed tributary remain stable. Based on information obtained from the USGS, the Crescent Road Site had met the required monitoring protocols for hydrology as it relates to bankfull events.

3.0 REFERENCES

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